

REMARKS

Claims 1-20 will be pending upon entry of the present amendment. Claims 1, 7-9, and 12 are being amended. Claims 13-20 are new. No new matter is being presented.

Although the Examiner indicated that claim 2 is directed to allowable subject matter and that claim 3 was rejected, it appears that claim 2 was intended to be rejected and claim 3 was intended to be indicated as allowable. In the discussion of the rejection of claims 1 and 3-12 on page 3, the Examiner asserted that the prior art teaches the elements of claim 2 but did not discuss claim 3. In addition, in the discussion of the allowable subject matter on page 4, the Examiner discusses the elements of claim 3 rather than claim 2. Accordingly, the applicants are treating claim 2 as being rejected and claim 3 as being allowable.

One embodiment of the invention is directed to a device that includes a piezoelectric resonator 1 formed on a suspension beam 2 that extends across a cavity 10. The device includes expandable elements 20, 21 mechanically coupled to the beam and positioned adjacent to heating elements 22, 23. The expandable elements 20, 21 have a thermal coefficient of expansion that differs from that of the suspension beam 2 such that, when the expandable elements are heated by the heating elements, the expandable elements deform the suspension beam as shown in Figures 1 and 2. Such a deformation of the beam 2 also deforms the resonator 1, which changes the resonance frequency of the resonator.

Claims 1-2 and 4-12 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 6,441,539 to Kitamura et al. ("Kitamura") in view of U.S. Patent Publication No. US 2003/0057806 to Peczalski.

Kitamura and Peczalski do not teach or suggest the invention recited in claim 1. Claim 1 recites a device with a piezoelectric resonator laid on a suspended beam, and "means for deforming said beam by a difference in thermal expansion coefficients." Kitamura and Peczalski do not teach or suggest such means for deforming a suspension beam.

The Examiner admits that Kitamura does not teach such deforming means, but incorrectly asserts that Peczalski does disclose such deforming means by using one or more heating resistors in thermal communication with a resonator. Peczalski simply does not mention any deformation of any suspension beam, such as the SiO₂ layer 12, or any difference in thermal

expansion coefficients. Paragraph 16 of Peczalski mentions heating an internal resistance 37 and/or one or more heating resistors 36 in thermal communication with the resonator, but never suggests that heating those elements 36, 37 causes a deformation of the SiO₂ layer 12 or any suspension beam or that the layers being heated have different thermal expansion coefficients.

Given that Peczalski clearly does not mention any beam deformation, the Examiner seems to be incorrectly relying on an inherency argument to show obviousness. First, inherency has no place in an obviousness rejection unless the inherency would have been obvious. The Examiner has not shown that any such inherency would have been obvious. Second, heating the elements 36, 37 does not inherently cause any deformation of any suspension beam. Certainly, the current in the elements 36, 37 could be low enough that none of the layers even expand, let alone expand enough to deform a suspension beam.

For the foregoing reasons, claim 1 is nonobvious in view of the cited prior art.

Claims 2 and 4-6 depend on claim 1, and thus, they are nonobvious for the reasons expressed above. In addition, claims 4-5 recite additional elements that are not taught or suggested by the cited prior art. Claim 4 recites that electrodes are placed in the beam opposite to electrodes external to the beam with the electrodes being connected to a voltage source capable of biasing the electrodes to maintain the beam deformation. Claim 5 adds that the external electrodes are in a cavity underlying the beam. First, given that the prior art does not teach or suggest any beam deformation, the prior art cannot possibly teach or suggest electrodes that can maintain such beam deformation when biased.

Second, the prior art does not teach or suggest electrodes in a suspension beam underlying a resonator. In Fig. 25, Kitamura shows a thin SiO₂ film 123 underlying the resonator, but there are not electrodes in that film 123. Similarly, Peczalski shows an SiO₂ layer 12 without any electrodes being in the layer 12. The only electrodes shown in Kitamura and Peczalski are the electrodes of the resonators themselves, but such electrodes cannot satisfy the claim language, because claim 4 specifies that the electrodes are in the suspension beam on which the resonator is laid. In contrast, Figure 2 of the present application shows electrodes 30, 31 in a suspension beam 2 and electrodes 32, 33 external to the beam.

Third, with respect to claim 5, the prior art does not teach or suggest any electrodes in a cavity underlying a suspension beam. Figures 1-24 of Kitamura do not show any suspension beam between the cavity 24 and the resonator, so there can be no electrodes in a cavity below such a non-existent suspension beam. Figures 25-40 and 44 of Kitamura show a cavity 124 underlying the thin SiO₂ film 123, but no electrodes are in the cavity 124. Figures 41-43 show a thin SiO₂ film 154 above a cavity 153, but there are no electrodes in the cavity 153. Peczalski shows an element 14, but does not mention whether it is a cavity or a substrate and does not show an electrode in the element 14.

For the foregoing reasons, claims 4-5 are nonobvious in view of the cited prior art.

Although the language of amended independent claim 7 and new independent claim 16 differs from that of claim 1, the allowability of claims 7 and 16 will be apparent in view of the discussion of claim 1.

Claims 8-15 and 17-20 depend on claims 7 and 16, respectively, and thus are also nonobvious in view of the prior art. In addition, each of new dependent claims 13-15 and 17-20 recites additional elements not taught or suggested by the cited prior art. Claims 13 and 18 include language similar to that of claim 3, which was indicated as being allowable. Claims 14-15 and 19-20 include language similar to that of claims 4-5, and thus, are allowable for substantially the same reasons as discussed above with respect to claims 4-5.

Claim 17 recites that an "expandable element is positioned on an upper surface of the suspension beam and has a larger thermal coefficient of expansion than said bridge, thereby causing a central region of the bridge to bend downward when the expandable element is heated." The cited prior art does not teach or suggest any element that causes a central region of a bridge to bend downward when the element is heated. Instead, Peczalski mentions that the heating elements 36, 37 merely adjust the frequency of a resonator without mentioning any central region of a bridge being bent downward.

Accordingly, claims 13-20 are in condition for allowance.

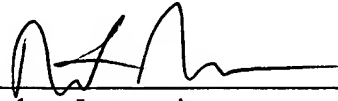
The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

Application No. 10/814,619
Reply to Office Action dated June 15, 2005

All of the claims remaining in the application are now clearly allowable.
Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

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